

9. Trematode Parasites from Animals dying in the Zoological Society's Gardens during 1911-1912. By WILLIAM NICOLL, M.A., D.Sc., M.D., F.Z.S.

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During the course of 1911 and 1912 opportunity was afforded me of making a fairly complete examination of the viscera of many of the animals dying in the Gardens. For this I have

* For explanation of the Plates see pp. 153-154.

to thank the courtesy of the Secretary and the officials at the Prosectorium. The animals were almost exclusively birds and reptiles or batrachians; no fishes, and only a few mammals were examined. The collection yielded between twenty and thirty species, a considerable proportion of which are new. Some of these have already been described in previous communications to the Society (Nicoll, 1911, 1912, *a*, *b*).

The reptilian parasites were the most interesting of those obtained, as several of them represented new generic types. They include forms from the Striped Snake, the Spiny-tailed Mastigure, Schott's Tree-Snake, and Smyth's Water-Snake.

Usually there was an interval of twenty-four hours, sometimes longer, between the death of the animal and the time of examination, but in spite of that the parasites in most cases were in a good state of preservation. In some instances, however, they were so macerated as to be almost useless. As might have been expected, parasites were more frequent in those animals which had been in the Gardens for the shortest period. Except in the few instances reported by Dr. Leiper (1912), there appears to be little probability of infection being acquired in the Gardens. In most cases the infections were not heavy, there being usually only a few worms present. Gross infections, however, were met with in the case of some Striped Snakes which were heavily infected with two larval Trematodes (Nicoll, 1912), and a Marsh Harrier which contained a large number of liver-flukes.

The first form I shall describe is an interesting new species from the Striped Snake (*Tropidonotus ordinatus*).

Family LEPODERMATIDÆ.

1. MEDIORIMA PROPRIA, gen. et sp. n. (Pl. I. fig. 1.)

This species is a typical member of the family Lepodermatidæ, to which a large proportion of reptilian trematodes belong. One specimen was obtained from the intestine of a Striped Snake (*Tropidonotus ordinatus*).

It is an elongated, slightly flattened Trematode, both ends of which are rounded. The cuticle is beset with small spines, which extend throughout the whole length of the body. The length is about 6 mm., the greatest breadth, near the middle of the body, is 1·2 mm.

The globular oral sucker has a diameter of ·5 mm.; the ventral sucker, which is somewhat oval, measures ·7 × ·8 mm., and is situated 1·7 mm. from the anterior end.

There is a very short prepharynx, and a pharynx measuring ·2 × ·17 mm. The œsophagus is about the same length as the pharynx. The intestinal diverticula are short, not extending very far (·4 mm.) beyond the ventral sucker. Their ends are obscured by the enormous mass of ova.

The genital aperture is median and is situated just behind the

intestinal bifurcation. The cirrus-pouch is short and stout, measuring $\cdot 8 \times \cdot 34$ mm. It is almost oval in outline. Within it there is a small convoluted vesicula seminalis, with a moderately long pars prostatica and a short ductus ejaculatorius. The vagina is somewhat shorter than the cirrus-pouch.

The small globular ovary is situated a short distance behind the ventral sucker on the right side and is largely concealed by the uterus. The anterior testis lies on the left about 1 mm. behind the ventral sucker, while the posterior testis lies a little further back on the right side. Both are almost entirely concealed by the uterus, so that their size and shape could not be determined. They are, however, apparently elongated oval in outline. The yolk-glands are scanty, consisting on each side of a little more than a single row of follicles external to the intestinal diverticula, and extending from midway between the genital aperture and the anterior edge of the ventral sucker to the level of the anterior testis.

The uterus fills up the greater part of the posterior two-thirds of the body. It consists of a narrow descending limb and a very greatly distended ascending limb, which is twisted into slight folds. The extremely numerous ova are dark brown in colour and measure $\cdot 039 \times \cdot 018$ – $\cdot 020$ mm.

This species bears a very close resemblance to the genus *Lechriorchis*, but is distinguished from it by the position of the genital aperture and the shape of the cirrus-pouch.

2. OMMATOBREPHUS SINGULARIS, gen. et sp. n. (Pl. I. fig. 2.)

A single specimen of this species was obtained from the intestine of the Spiny-tailed Mastigure (*Vromastix acanthinurus*). It presents several features of interest.

The length of the specimen, slightly pressed, is 2.73 mm., and the maximum breadth across the ventral sucker is .8 mm. The anterior part of the body is considerably attenuated, the posterior part is more rounded but terminates in a somewhat acute point. There are no cuticular spines.

The subterminal oral sucker has a diameter of .18 mm. and the ventral sucker measures .53 mm. The latter is situated at a distance of 1.06 mm. from the anterior end. Contiguous with the oral sucker is a large pharynx, measuring $\cdot 12 \times \cdot 14$ mm. This is followed by a long oesophagus, .31 mm. in length. The intestinal bifurcation takes place a little in front of the ventral sucker, and the short diverticula terminate about midway between the ventral sucker and the testes.

The excretory vesicle is Y-shaped with a short sinuous stem, bifurcating a little in front of the testes, and limbs extending nearly to the level of the pharynx.

The genital aperture is median, just over the intestinal bifurcation. The cirrus-pouch is stout and almost globular, lying almost entirely in front of the ventral sucker. Its length and diameter are about .2 mm. It is thin-walled and contains a thick

highly-convoluted vesicula seminalis with a short prostate and ductus. The testes lie alongside one another, almost at the posterior end of the body. They are slightly asymmetrical, the left being a little in advance of the right, and they are separated by a narrow fold of the uterus. They are elongated oval in outline and measure $\cdot35 \times \cdot22$ mm.

A little in front of the testes lies a small round ovary, somewhat on the right side of the middle line. The shell-gland complex is entirely obscured by the uterus. The yolk-glands are of restricted extent, being confined to the extreme edges of the body and extending only from the ovary to some distance behind the ventral sucker. The uterus fills up the whole of the middle of the body and sends a small loop down between the testes. The eggs are thin-walled and very transparent, and the majority of them contain a fully developed miracidium, the X-shaped eye-spots of which are very conspicuous. The eggs measure $\cdot095 \times \cdot056$ mm.

This form evidently belongs to the family Lepodermatidæ, but it is somewhat aberrant. Its most distinctive features are the unusual position of the genital glands and the precocious development of the miracidia, together with the large size of the eggs.

3. OPISTHOGENES INTERROGATIVUS, gen. et sp. n. (Pl. II. fig. 4.)

Five specimens of this parasite were obtained from the intestine of Schott's Snake (*Philodryas schotti*). In length they vary from 4.5 mm. to 6.2 mm. (pressed specimens); the average is 5.4 mm. The greatest breadth across the ventral sucker is 1.7 mm. The outline is almost fusiform, the posterior half being more attenuated than the anterior.

Both suckers are nearly globular, the oral measuring .64 mm. and the ventral .56 mm. In both cases the longitudinal diameter is usually slightly greater than the transverse. The ventral sucker is situated 1.74 mm. from the anterior end. There is a short prepharynx followed by a pharynx measuring $\cdot21 \times \cdot2$ mm. The œsophagus is slightly longer than the pharynx, .27 mm. The intestinal diverticula terminate some distance (about .6 mm.) from the posterior end of the body, but their ends are obscured by the dense mass of the uterus.

The excretory vesicle is long and wide. The median stem runs forward to near the ovary before dividing into the two short lateral branches. The vesicle, as well as the main collecting tubules, are clearly mapped out owing to the pigmented nature of their contents. A large number of fine branches are given off from the vesicle, and these form an anastomosing network throughout the whole body.

The cirrus-pouch has the shape of an interrogation mark, curving over the left posterior quadrant of the ventral sucker. Its proximal end lies a short distance behind the sucker, while the male genital aperture is 1 mm. behind the sucker and a little to the left of the middle line. The female aperture is separated

from the male but immediately behind it. The cirrus-pouch contains a highly convoluted vesicula seminalis, a short pars prostatica, and a long straight ductus and cirrus. The musculature of the pouch and of the cirrus is extremely well developed.

The anterior testis lies on the left side, near the genital aperture. The second testis lies on the other side of the body, and is separated from the first by the uterus. The anterior border of the one is about .2 mm. in front of that of the other. Both are somewhat elongated oval in outline, their long diameter measuring .5-.65 mm. They are moderately thick and are not much overlapped by the uterus.

The ovary lies not far behind the ventral sucker, alongside the proximal end of the cirrus-pouch. It is globular and considerably smaller than the testes. It is usually difficult to see, owing to its being obscured by the uterus. Laurer's canal is present, but there is no receptaculum seminis. The initial part of the uterus is filled with sperms. The yolk-glands have an unusual disposition. Instead of being lateral they are entirely dorsal. Situated in the posterior half of the body, they extend from the level of the genital aperture to a short distance (.4 mm.) behind the testes. They consist of fairly large follicles which lie between the excretory vesicle and the cuticle, and which do not spread to the outer side of the intestinal diverticula.

Starting from the ovary, the uterus forms several small dorsal convolutions on its way towards the posterior end of the body. On turning forward it becomes greatly dilated. At first it runs almost straight forwards, then bends towards the left testis. Passing between the testes it forms a fairly large convolution in front of the right testis. It then passes across the ventral sucker and finally runs down along the left side of the cirrus-pouch. It overlaps the intestinal diverticula to a considerable extent. The vagina is a wide muscular structure about half the length of the cirrus-pouch. The ova are very numerous, dark brown in colour, and measure .020-.023 \times .013-.014 mm.

This species is most closely allied to *Opisthogonimus philodryochus* West, but it appears to present features of sufficient importance to warrant its being regarded as the type of a distinct genus. The chief distinctive features are the position of the genital aperture, the shape and structure of the cirrus-pouch, and the position of the yolk-glands.

4. OPISTHIOGLYPHE ADULESCENS, sp. n. (Pl. I. fig. 3.)

A few specimens of this form were taken from the intestine of an Asp Viper (*Vipera aspis*). They were all obviously immature, and on that account the following can only be regarded as a provisional description. For the same reason it is impossible to be absolutely certain that this form is distinct from the already known species of the genus, but one or two distinctive features seem to point to the fact that it is a separate species.

In shape it is elongated oval with somewhat pointed ends and almost parallel sides. The length is about 1·3 mm. and the greatest breadth ·46 mm. The cuticle is beset for at least three-quarters of the length of the body with minute spines. The oral sucker is subterminal and has a diameter of ·17 mm. The round ventral sucker is much smaller, measuring only ·10 mm., and it is situated at a distance of ·55 mm. from the anterior end of the body.

There is a short prepharynx, a pharynx measuring ·06 × ·08 mm., and a long œsophagus, twice the length of the pharynx. The intestinal diverticula are rather wide, and do not extend more than halfway between the ventral sucker and the posterior end of the body. The excretory vesicle is dilated and the median stem divides a short distance behind the ovary. The paired limbs only extend to the ventral sucker.

The genital aperture lies a short distance behind the intestinal bifurcation. The cirrus-pouch is short and plump, reaching only a short distance behind the anterior border of the ventral sucker. It contains a highly convoluted vesicula seminalis, a short pars prostatica, and a short ductus ejaculatorius. The testes lie at the level of the end of the intestines. They are tandem or slightly oblique, and almost contiguous. They are of very irregular shape, and are always broader than long. Their dimensions are about ·06 × ·13 mm. The post-testicular space is almost exactly one-quarter of the body-length.

The ovary is contiguous with the ventral sucker on its right posterior border. It also touches the right intestinal diverticulum. Its size is ·08 × ·06 mm. The yolk-glands are extremely scattered and imperfectly formed. They consist of small, rather isolated follicles extending along the sides of the body from the middle of the œsophagus to the middle of the post-testicular space. In the latter they extend inwards but do not meet in the middle line. They overlap the intestinal diverticula only to a very slight extent. The uterus is confined between the testes and the ventral sucker, and does not overlap the intestinal diverticula. It contains about two dozen eggs, measuring ·042 × ·021 mm.

It does not appear likely that this can be the young stage of any of the already known species of *Opisthioglyphæ*, for it is differentiated from *O. rance* by the length of the intestinal diverticula and the ratio of the suckers. The configuration of the excretory vesicle is also different. From *O. hystrix* it differs in the position of the ventral sucker, the length of the intestinal diverticula and of the cirrus-pouch, and the extent of the yolk-glands. It also differs in several important particulars from the more recently described *O. locellus* Kossack. I am unable to compare it with *O. siredonis*, as Poirier's paper is not available.

5. STYPHLODORA PERSIMILIS, sp. n. (Pl. II. fig. 5.)

About thirty specimens of this parasite were removed from the ureters of an Indian River-Snake (*Tropidonotus piscator*)

which died in the Gardens on December 4th, 1911. Owing to its extreme resemblance to *S. serrata* Lss. and *S. horrida* (Leidy), I have had considerable hesitation in deciding to regard it as a new species. Coming, however, from such different hosts as the Egyptian Monitor (*Varanus niloticus*), *Boa constrictor*, and the present host, and from such widely separated parts of the world as Egypt, North America, and India, the probability is that they represent three distinct species. It also bears some resemblance to *S. najae* Nicoll (1912) from the Indian Cobra, though the length of the intestinal diverticula and the size of the suckers appear to be characters sufficient to separate it from that species.

The length of mature specimens is 3-4 mm. and the maximum breadth .9-1.0 mm. just behind the ventral sucker. The cuticle is beset with fairly prominent spines throughout practically its whole extent.

The oral sucker measures .24-.28 mm. in diameter and the ventral sucker .28-.34 mm. The latter is almost invariably transversely elongated, its average diameter being $.29 \times .33$ mm. The oral sucker is sometimes elongated, sometimes transverse, the latter being usually the case, and its average dimensions are $.25 \times .26$ mm. The ratio of the mean diameters of the suckers is therefore about 5:6; it is always greater than 4:5 and never greater than 6:7. In *S. najae* and *S. serrata* the suckers are much more nearly equal. The ventral sucker is situated at a distance of .6-8 mm. from the anterior end of the body. The neck thus comprises only about one-fifth of the body-length, but it may be remarked that the specimens were somewhat contracted.

There is no pharynx, and the pharynx measures $.17 \times .13$ mm. The oesophagus is about .1 mm. long, and the intestinal bifurcation takes place close in front of the ventral sucker. The intestinal diverticula are practically equal in length, and extend to a distance of .65-.9 mm. from the posterior end. The average in about a dozen specimens was .76 mm., which is almost exactly two-ninths of the body-length. They are therefore practically about the same length as those in *S. serrata*.

The median genital aperture is immediately in front of the ventral sucker. The cirrus-pouch just reaches the posterior border of the ventral sucker, and is frequently contiguous with the ovary. The latter is globular, with a diameter of .2 mm. Behind it lies the receptaculum seminis. The anterior testis, on the left, lies about .25 mm. from the posterior border of the ventral sucker, though the distance varies from .18 mm. to .38 mm., according to the state of contraction. The posterior testis, on the right, is separated from the other by a distance of .17 mm., though this again varies. The anterior border of the right testis is usually a little in advance of the posterior border of the left.

The yolk-glands have the usual situation, almost entirely

external to the intestinal diverticula, and extend from the posterior border of the ventral sucker to the middle of the anterior testis. The uterus, which is voluminous, bears a close resemblance to that of *S. serrata*, and the ova measure $\cdot 039\text{--}\cdot 047 \times \cdot 019\text{--}\cdot 020$ mm.

Family DICROCÆLIIDÆ.

6. *LYPEROSOMUM SCITULUM*, sp. n. (Pl. III. fig. 6.)

Four specimens of this species were taken from the liver of a Purple-capped Lory (*Lorius domicella*). It is a greatly elongated form, measuring 6·8–7·2 mm. in length. The breadth is fairly uniform, but attains its maximum (·8 mm.) across the ventral sucker. There are no cuticular spines.

The oral sucker is almost terminal, and has a diameter of ·45 mm.; the ventral sucker is slightly smaller, ·42 mm., and is situated 1·33 mm. from the anterior end. The pharynx is contiguous with the oral sucker, and has a diameter of ·14 mm.; the œsophagus is about the same length. The narrow tortuous intestinal diverticula extend down the sides of the body to a distance of about 2 mm. from the tip of the tail. They are of unequal length, sometimes the right, sometimes the left being the longer.

The anterior testis is separated from the ventral sucker by a space of ·33 mm. The posterior testis lies about the same length behind the first, the latter being close against the right intestinal diverticulum and the former against the left diverticulum. They are oval bodies measuring about $\cdot 25 \times \cdot 33$ mm. The space between the second testis and the ovary is equal to that between the two testes. The ovary is a transversely oval body situated in the middle line and measuring $\cdot 21 \times \cdot 24$ mm. The genital aperture lies over the intestinal bifurcation. The cirrus-pouch is fairly stout, and extends to the anterior border of the ventral sucker. It contains a highly convoluted, voluminous vesicula seminalis and a moderately long prostate and ductus.

The yolk-glands are limited to an area on each side of the body about the level of the ovary. They are variable in extent, but as a rule their anterior limit is on a level with the second testis, while their posterior limit is about half as far again on the other side of the ovary. They are usually more extensive on one side of the body than on the other. They almost completely overlap the intestinal diverticula. The uterus is very highly convoluted, the loops being mostly transverse. It fills up almost all the posterior part of the body not occupied by the genital glands, which it does not overlap. It does, however, overlap the intestinal diverticula to a very considerable extent. The eggs are extremely numerous, and measure $\cdot 029 \times \cdot 019$ mm. The older ones contain the characteristic miracidium larva.

7. *LYPEROSOMUM DIREPTUM*, sp. n. (Pl. III. fig. 7.)

Three fragments of this species were obtained from the liver of a Crested Curassow (*Crax alector*). From these it was possible to get a fairly accurate idea of the whole animal. It is about 9 mm. long and about .9 mm. broad at its broadest part, which is just behind the ventral sucker. The neck narrows rather abruptly, but the posterior part of the body gradually narrows to an acutely pointed tail. At a distance of 1 mm. from the tip of the tail the breadth is less than half what it is behind the ventral sucker. There are no cuticular spines.

The globular oral sucker measures $.35 \times .39$ mm., the ventral sucker $.46 \times .42$ mm., and the latter is 1.03 mm. from the anterior end. In one fragment belonging to a specimen apparently well over 10 mm. in length, the ventral sucker had a diameter of .54 mm. and the maximum breadth of the body was 1.1 mm. The pharynx is contiguous with the oral sucker, and measures $.17 \times .14$ mm. There is practically no œsophagus, the intestinal diverticula branching out directly from the pharynx. The diverticula terminate a considerable distance from the tip of the tail, but the ends are obscured by the uterus, and could not be made out.

The genital aperture lies immediately behind the pharynx. The small slender cirrus-pouch, .3 mm. in length, is slightly curved, and does not reach the ventral sucker. The testes are close behind the ventral sucker, the left being in advance, but only by the distance of its own diameter, so that the posterior border of one is on the same level as the anterior border of the other. They are almost globular, and their diameter varies from .24 mm. to .31 mm.

The globular ovary is separated from the posterior testis by a space of .6 mm. It lies somewhat to the right side, and is rather larger than the testis, having a diameter of .34-.41 mm. Behind it lies a small globular receptaculum seminis. The yolk-glands are much more extensive than in the preceding species. They reach from the level of the posterior testis to halfway between the ovary and the tip of the tail. They are more extensive on one side than on the other. The uterus is very voluminous and highly convoluted, but the convolutions are not quite so regularly disposed as in *L. scitulum*. The very numerous eggs measure $.025-.028 \times .019-.021$ mm.

8. *BRACHYCÆLIUM OBESUM*, sp. n. (Pl. III. fig. 8.)

A few specimens of this species were obtained from the intestine of a Summer Snake (*Contia aestiva*), which died in the Gardens on July 2nd, 1911. They were all, unfortunately, in a very contracted state, and it was only with some difficulty that their internal anatomy could be made out. At first sight they appeared to be identical with *B. salamandre*, but their exceedingly small size and the fact that even the smallest was fully mature, raised

suspicion that this could not be the case. It was difficult, however, to obtain other grounds for regarding them as a distinct species. These relate only to slight differences in the size of the suckers, the cirrus-pouch, and the ova.

The body in its contracted state is plump and equally rounded at both ends. In some specimens each end is curled ventrally. The length of the smallest specimen was $\cdot75$ mm. and of the largest $1\cdot4$ mm., though the latter had been subjected to a certain amount of pressure. In the natural state the length is probably $1\text{--}1\cdot5$ mm. The greatest breadth, in the middle of the body, is $\cdot4\text{--}\cdot65$ mm. The cuticular spines are rather minute.

The suckers are more unequal than in *B. salamandrae*. The diameter of the oral sucker is $\cdot17\text{--}\cdot25$ mm., the average being $\cdot22$ mm. The ventral sucker only measures $\cdot11\text{--}\cdot15$ mm., with an average of $\cdot135$ mm. The ratio is therefore very nearly $5:3$ instead of $5:4$, as in *B. salamandrae*. The ventral sucker is also nearer the middle of the body, being about two-fifths of the total length from the anterior end.

The pharynx measures $\cdot075 \times \cdot07$ mm.; the œsophagus is short, and the dilated intestinal diverticula reach the level of the middle of the ventral sucker.

The genital aperture has the same position as in *B. salamandrae*, but the cirrus-pouch is much longer and more slender, and it extends right across the ventral sucker to its posterior border. It contains a very large bipartite vesicula seminalis, of which the posterior portion is the larger. The transversely oval ovary lies on the left side immediately behind and overlapping the ventral sucker. Just behind it, and a little external, lies the left testis, while on the other side, on the same level, lies the right testis. The ovary measures $\cdot13 \times \cdot07$ mm.; the testes are somewhat larger. The yolk-glands extend from about the middle of the oral sucker to the level of the ovary. The uterus is very voluminous, and fills up the whole of the posterior part of the body. The arrangement of the convolutions cannot be made out, as they are so closely packed together, but it is noticeable that most of the young eggs are near the tail, while the older eggs occupy a more forward position. The eggs are thick-shelled and somewhat larger than those of *B. salamandrae*, measuring $\cdot050\text{--}\cdot052 \times \cdot034\text{--}\cdot036$ mm.

This species differs from *B. hospitale* Stafford (1903) in having relatively larger and more unequal suckers. The intestinal diverticula are somewhat longer, and the ova are considerably larger. It is altogether a much smaller species.

Family ECHINOSTOMIDÆ.

9. ECHINOSTOMUM ALIUD, sp. n. (Pl. IV. figs. 9, 9 a.)

Four specimens of this parasite were obtained from the intestine of a Ruddy Flamingo (*Phœnicopterus ruber*). It is an elongated,

somewhat flat species, with a pronounced cervical concavity. As in many other species of the genus, the head has a tendency to be bent sharply on to the ventral surface of the body.

The specimens measured 2.9–6.3 mm. in length. One, 4.6 mm. in length, was immature, but another, of 5.6 mm. in length, was full of ova, so that the maturity length is probably about 5 mm. The greatest breadth, across the ventral sucker, is about one-fifth of the length. Behind the ventral sucker the breadth is fairly uniform, but the tail is distinctly pointed. The breadth across the head is about one-tenth of the body-length.

There are 35 cephalic spines, arranged in the typical fashion in two uninterrupted rows, with a group of five terminal spines at each end. In the anterior row the spines are slightly shorter than in the posterior row, the average size being .099 mm. and .103 mm. respectively. The terminal spines are slightly smaller, measuring .093 mm. The shortest spine on either side is the superficial spine third from the inner end of the terminal group. In the only specimen in which its dimensions could be accurately determined, it measured .091 mm. on the right side and only .078 mm. on the left. The cephalic spines present two peculiarities which have not apparently been observed in any hitherto described species of *Echinostomum*. In the first place their shape is unusual. Instead of the common symmetrical peg-shape, their distal end is inflated in the form of a somewhat triangular knob, which is slightly sculptured. The knob is situated on the upper surface of the spine, and comprises about one-third of its total length. An idea of its shape will best be gathered from reference to fig. 9a. There is the further peculiarity that each spine is connected to the edge of the cephalic disc by a thin web-like membrane which is joined to the spine along pretty nearly its whole length.

The whole of the neck, both dorsally and ventrally, is covered with stout cuticular spines, but these do not extend very far beyond the ventral sucker.

In a 5.6 mm. specimen the large oral sucker measures .22 mm. in diameter, and the ventral sucker .72 mm. The latter is usually globular, but in one case it was somewhat deepened. It lies at a distance of 1.43 mm. from the anterior end. The neck is thus a little more than one-fourth of the body-length. There is a short prepharynx about .06 mm. in length, followed by a pharynx measuring .19 × .13 mm. The oesophagus is about .46 mm. in length, and the bifurcation occurs just in front of the ventral sucker. The diverticula are somewhat crenated, and extend right to the posterior end of the body.

The genital aperture lies in the middle line just over the intestinal bifurcation. The cirrus-pouch is small and stout, and overlaps the ventral sucker only to a slight extent. Its dimensions are .45 × .18 mm., and it encloses a convoluted vesicula seminalis, a short pars prostatica, and a twisted ductus and cirrus. The testes are rather small and of irregular contour, there being

usually a slight indentation on either side about the middle of their length. Their dimensions are $\cdot34 \times \cdot25$ mm. The posterior testis is a trifle larger than the anterior one. They are very close together, but are not quite contiguous. In front they are separated from the ovary by a space of $\cdot15$ mm.; behind them the post-testicular space is $1\cdot68$ mm. in length.

The small transversely oval ovary is situated $1\cdot02$ mm. behind the ventral sucker. It is almost median, and measures $\cdot15 \times \cdot21$ mm. The yolk-glands are rather restricted in extent. On each side they reach the posterior border of the ventral sucker; posteriorly they cease at some distance from the tip of the tail. They are for the most part confined to the outer side of the intestinal diverticula, and overlap them only to a very slight extent. The transverse yolk-ducts cross between the ovary and anterior testis. The uterus does not overlap the intestinal diverticula, and is confined between the ovary and the ventral sucker. The ova are very large, measuring $\cdot114\text{--}\cdot122 \times \cdot069\text{--}\cdot074$ mm.

Family CLINOSTOMIDÆ.

10. HARMOTREMA INFECUNDUM, gen. et sp. n. (Pl. IV. fig. 10.)

A considerable number of specimens of this species was obtained from the intestine of Smyth's Water-Snake (*Grayia smythii*). It is one of the most remarkable forms in the present collection.

It is a small, rather flat species, white in colour and with the edges of the body thrown into irregular wrinkles. The cuticle is unarmed.

It is about 2 mm. in length, with a fairly uniform breadth of $\cdot6$ mm. Both ends are slightly pointed. The suckers are small and feeble, the oral having a diameter of $\cdot13$ mm. and the ventral $\cdot08 \times \cdot10$ mm. The latter lies $\cdot8$ mm. from the anterior end.

There is no prepharynx; the pharynx measures $\cdot06 \times \cdot04$ mm., and the œsophagus is about the same length as the pharynx. The intestinal diverticula are wide and sinuous, and reach the posterior end of the body. Behind the ventral sucker they usually bend inwards before passing out again to make room for the genital glands. At their termination they again turn in towards the middle line.

The genital aperture is situated on the left side of the body, internal to the intestinal diverticulum and almost midway between the ventral sucker and the posterior end of the body. The curious thin-walled cirrus-pouch stretches forwards from the genital aperture in a zigzag or sinuous fashion, and its proximal end lies against the right intestinal diverticulum. It contains a bipartite vesicula seminalis, of which the proximal part is oval and the distal elongated. There is a moderately

long fusiform pars prostatica and a long curved ductus ejaculatorius.

The testes are two irregularly lobed bodies lying behind the cirrus-pouch. The anterior is just behind the genital aperture but on the right side of the body. The posterior lies between the ends of the intestinal diverticula, and is separated from the end of the body by a space equal to its own diameter.

Between the testes lies the much smaller ovary. It is also irregularly lobed, but not so distinctly as the testes. It is separated from the posterior testes by a large yolk receptacle. The yolk-glands extend a considerable part of the length of the intestinal diverticula and lie both internally and externally to them, but not to any great extent dorsally or ventrally. Their anterior limit is midway between the intestinal bifurcation and the ventral sucker. Posteriorly they cease at the ends of the intestines. The uterus is extremely short and does not usually contain more than two eggs. The latter are comparatively huge but very variable in size. The normal size appears to be about $\cdot 15\text{--}18 \times \cdot 08\text{--}11$ mm. They lie alongside the ovary and testes.

This species evidently bears a close resemblance to the genus *Harmostomum*, but differs from it particularly in the position of the uterus and the size of the eggs.

HOLOSTOMATA.

11. HEMISTOMUM CANALICULATUM, sp. n. (Pl. IV. fig. 11.)

A few specimens of this parasite were obtained from the intestine of an Egyptian Eagle-Owl (*Bubo ascalaphus*). It is of moderate size, $1\cdot 6\text{--}2\cdot 9$ mm. in length. The anterior part of the body is considerably longer than the posterior part, in the ratio of 5 : 3 on an average. When expanded the anterior part of the body is almost oval in outline, with a pointed tip. The lateral glandular pits are not very well marked. When contracted the body is almost uniformly cylindrical. The long axis of the two parts are almost in the same straight line; so that there is little dorsal flexure. The posterior part of the body may attain a breadth of $\cdot 7$ mm.

The small oral sucker measures $\cdot 08\text{--}09$ mm. The ventral sucker is slightly larger ($\cdot 1$ mm.), and is situated at a distance of $\cdot 6$ mm. from the anterior end in a specimen $2\cdot 4$ mm. long. The pharynx is contiguous with the oral sucker and somewhat larger than it, measuring $\cdot 08\text{--}1 \times \cdot 06\text{--}08$ mm. The short œsophagus measures only $\cdot 03\text{--}04$ mm. The diverticula have the usual configuration.

The most characteristic feature of the species is the clinging-plug, which is situated immediately behind the ventral sucker. It is an oval structure about four times as long as the ventral sucker and two or three times as broad. It does not conceal

the ventral sucker, but in the older specimens it overlaps the posterior border of the sucker. It is not much raised above the surface of the body, and is traversed by a deep median longitudinal furrow which extends along its whole length. In well-expanded specimens the furrow is much shallower. A similar furrow exists in *H. pileatum* (Rud.).

The genital glands do not display any striking peculiarities, except that the testes are reniform in transverse section and the yolk-glands extend forward only to about .5 mm. from the anterior end. Their anterior edge forms a semi-circle with the convexity directed forward.

The ova measure .105-.11 × .065-.07 mm.

This species bears most resemblance to *H. spathula* (Creplin), but differs from it in several important details. In the latter the two parts of the body are nearly equal; the oral sucker and the pharynx are only half as large, while the clinging-plug is much larger and does not display the longitudinal furrow. The yolk-glands, too, are probably more extensive.

The following is a list of the hosts and of the Trematode parasites obtained from them:—

MAMMALS.

ANOA DEPRESSICORNIS.

Fasciola gigantea (Cobbold) Liver.

BIRDS.

CIRCUS ÆRUGINOSUS. Marsh Harrier.

Metorchis crassiusculus (Rud.) Liver and Gall-bladder.

BUBO ASCALAPHUS. Egyptian Eagle-Owl.

Hemistomum canaliculatum Nicoll Intestine.

LARUS RIDIBUNDUS. Black-headed Gull.

Gigantobilharzia acotylea Odhner Mesenteric veins.

LARUS FUSCUS. Black-backed Gull.

Tocotrema lingua (Creplin) Intestine.

LARUS ATRICILLA. Laughing Gull.

Tocotrema lingua (Creplin) Intestine.

ALCA TORDA. Razorbill.

Hemistomum pileatum (Rud.) Intestine.

Metorchis xanthosomus (Creplin) Gall-bladder.

CEDEMIA NIGRA. Black Scoter.

Catatropis verrucosa (Froelich) Cæca.

Paramonostomum alveatum (Mehlis) Intestine.

LORIUS DOMICELLA. Purple-capped Lory.

Lyperosomum scitulum Nicoll Liver.

PHENICOPTERUS RUBER. Ruddy Flamingo

Echinostomum aliud Nicoll Intestine.

CRAX ALECTOR. Crested Curassow.

Lyperosomum direptum Nicoll Liver.

REPTILES.

TROPIDONOTUS ORDINATUS. Striped Snake.	
<i>Cercaria ordinata</i> Nicoll	Mesentery.
<i>Diplostomum sirtale</i> Nicoll	Mesentery.
<i>Mediorima propria</i> Nicoll	Intestine.
TROPIDONOTUS PISCATOR. Indian River-Snake.	
<i>Styphlodora persimilis</i> Nicoll	Ureters.
TROPIDONOTUS NATRIX. Common Snake.	
<i>Cercorchis nematoides</i> (Mullling)	Intestine.
NAJA TRIPUDIANS. Indian Cobra.	
<i>Xenopharynx solus</i> Nicoll	Gall-bladder.
<i>Styphlodora najæ</i> Nicoll	Ureters.
PHILODRYAS SCHOTTI. Schott's Snake.	
<i>Opisthogenes interrogativus</i> Nicoll	Intestine.
GRAYIA SMYTHII. Smyth's Water-Snake.	
<i>Harmotrema infecundum</i> Nicoll	Intestine.
VIPERA ASPIS. Asp Viper.	
<i>Opisthoglyphe adulescens</i> Nicoll	Intestine.
<i>Cercaria ordinata</i> Nicoll	Mesentery.
CONTIA ÆSTIVA. Summer Snake.	
<i>Brachycælium obesum</i> Nicoll	Intestine.
UROMASTIX ACANTHINURUS. Spiny-tailed Mastigure.	
<i>Ommatobrephus singularis</i> Nicoll	Intestine.

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EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. *Mediorima propria*. × 20.
 2. *Ommatobrephus singularis*. × 40.
 3. *Opisthoglyphe adulescens*. × 70.

PLATE II.

- Fig. 4. *Opisthogenes interrogativus*. × 25.
5. *Styphlodora persimilis*. × 40.

PLATE III.

- Fig. 6. *Lyperosomum scitulum*. × 23.
7. *Lyperosomum direptum*. × 18.
8. *Brachycoelium obesum*. × 100.

PLATE IV.

- Fig. 9. *Echinostomum aliud*. × 20.
9a. " " Cephalic spine. × 250.
10. *Harmotrema infecundum*. × 60.
11. *Hemistomum canaliculatum*. Transverse section through
clinging-plug. × 65.

Figures 1-10 are drawn from the ventral surface.

C.B. Cirrus-pouch.
Ex. Excretory vesicle.

K.St. Ovary.
T, T₁, T₂. Testes.